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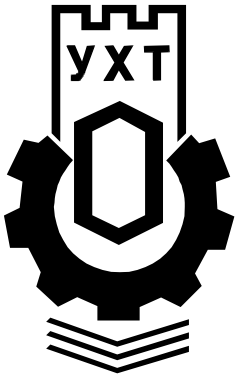

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КОРЕЛАЦИЯ МЕЖДУ НЯКОИ МОРФОЛОГИЧНИ И БИОХИМИЧНИ СВОЙСТВА НА ОРИЗ (*Oryza sativa* L.)

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CORRELATION BETWEEN SOME MORPHOLOGICAL AND BIOCHEMICAL TRAITS OF RICE (ORYZA SATIVA L.)

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Abstract

The relationship between some morphological and biochemical traits in ten domestic rice varieties (Kocanski, Osogovka, Biser-2, Nada-115, Ranka, Prima riska, Montessa, N^{o} 51, N^{o} 69 and B 30-303), and three lines of special interest (79/22-2, 78/12-3-4 and 78/12-3-5) were analyzed. The results showed that shape of grain has the highest significantly positive correlation with length of grain (r=0.897). Number of grain per panicle is significantly correlated with mass of grains per panicle (r=0.877) and fertility with leaf area (r=0.689). Proteins content has significantly negative correlation with iron in paddy (r=-0.862) and with carbohydrates content in white rice (r=-0.686), while iron content with width of grain (r=-0.719 in paddy). The derived results can be used as selection index for future rice improvement.

Keywords: *rice, morphological traits, biochemical traits, correlation.*

Introduction

Rice is a one of the major agricultural crop in the world which is used in nutrition of the population. In the Republic of Macedonia the production of rice is an important industry because fully satisfies the needs of domestic rice and also is an export oriented. The rice production takes a place mainly in the Eastern part of the country, along the river Bregalnica. About 90% of total production is produced in Kocani region and the remaining 10% in Stip, Vinica end Veles region.

Rice is an important source of starch and protein. However, rice scientists have long recognized its micronutrient deficiencies, which are the basis of numerous human health problems worldwide (Welch et al., 2004). Rice is a poor source of essential micronutrients such as Fe and Zn (Bouis, and Welch, 2010, according Anuradha et al., 2012). It only has limited contents of Fe and Zn, and moreover the loss of minerals, particularly of Fe, during rice milling is high (Doesthale et al., 1979, according Tamanna et al., 2013). There is few available information on the relationship between 8 mineral elements, plant morphological and grain quality traits in Yunnan rice. Therefore, advance in understanding this relationship can provide reference for rice quality breeding and special rice industrialization (Ya-wen et al., 2005).

For selection in rice, information on correlation coefficient always has been helpful as a basis for selection in a breeding programme (Akhtar et al., 2011). The aim of this research was to analyze the relationship between some morphological and biochemical traits in different rice genotypes from Macedonia.

Materials and Methods

Ten rice varieties from Macedonia (*No 51, No 69, B-30-303, kocanski, nada-115, ranka, osogovka, biser-2, prima riska and montesa),* and three lines of special interest (*79/22-2, 78/12-3-4 and 78/12-3-5),* were grown on the experimental areas for rice in Kocani. Polish experiments were performed by using

randomized block system in three repetitions. The standard growing measures were applied during the vegetation. The morphological traits (culm height, leaf length, leaf width, panicle length, number of grains in panicle, mass of grains per panicle, 100-grains weight, grain length and grain width) are determined according to the International descriptors for rice (Bioversity International, IRRI and WARDA, 2007; IBPGR and IRRI, 1980). Based on the number of full and empty grains per panicle is calculated the percentage of fertility and from length and width of the leaf is calculated the leaf area. The length and width of the grain, are measured with caliper, and from the ratio of the measured values, was determine the shape of grain. From the biochemical traits were examined the content of soluble carbohydrates, protein content and content of microelements iron – Fe, zinc – Zn and copper – Cu in categories paddy, cargo and white rice. For getting cargo category, paddy is peeled by hand machine and for getting white rice, bleaching is performed with rice electrical peeling machine. The content of soluble carbohydrates is determined by the method of Dubois et al., 1956, the total nitrogen content is determined by the method of micro Kjeldahl, and the content of microelements is determined by the method of wet combustion and atomic absorption spectroscopy type – PERNIN ELMER 200.

The relationship between examined traits is calculated using software SPSS.

Results and Discussion

The coefficient of correlation between analyzed morphological traits is given in table 1. Significantly positive correlation was obtained between shape and length of grain (r=0.897), mass and number of grains per panicle (r=0.877) and between fertility and the leaf area (r=0.689). The leaf area is positively correlated with the length of leaf (r=0.611) but only at significant level p=0.05. Positive correlation at significant level, p=0.05 exists between grain length and 100 grains weight (r=0.577) and between fertility and panicle length (r=0.569). The width and length of leaf showed negative relationship and correlation coefficient (r=-0.608) significant only for p=0.05.

The results from inter correlation of different morphological traits in rice are presented in researches of Naseem et al., 2014, Maji and Shaibu, 2012, Ashfaq et al., 2012, Zahid et al., 2006. Generally, the panicle length is positively correlated with culm height, the number of grains per panicle with panicle length and leaf area. Direct effect on the yield per plant has the number of grains per panicle and 1000 grains weight.

Table 1. Correlation between some morphological traits of the rice genotypes analyzed

Traits	Leaf length	Leaf width	Leaf area	Panicle length	Number of grains per panicle	Fertility	Mass of grains per panicle	100-grains weight	Grain length	Grain width	L/B ratio
Culm height	0.447	-0.238	0.295	0.366	0.014	0.094	-0.041	-0.118	0.328	0.419	0.105
Leaf length		-0.608*	0.611*	0.408	-0.014	0.227	-0.217	-0.472	0.114	0.074	0.077
Leaf width			0.245	0.081	-0.008	0.410	0.040	0.163	0.036	-0.129	0.097
Leaf area				0.519	-0.078	0.689**	-0.276	-0.432	0.149	0.419	0.177
Panicle length					0.521	0.569*	0.356	-0.180	0.050	0.339	-0.115
Number of grains per panicle						0.107	0.877**	0.084	0.192	-0.069	0.175
Fertility							0.102	-0.007	0.073	0.194	-0.020
Mass of grains per panicle								0.545	0.433	0.118	0.304
100-grains weight									0.577*	0.326	0.354
Grain length										-0.030	0.897**
Grain width											-0.466

Level of significant p=0.01**
Level of significant p=0.05*

The relationship between the analyzed biochemical traits at paddy, cargo and white rice from examined genotypes is given in table 2, 3 and 4 respectively. In paddy (table 2) negative mutual dependence, with high significant was obtained for the content of iron and protein content (r=-0.862). Highly significant negative correlation of protein content was found in the content of carbohydrates in white rice (r=-0.686). At other analyzed traits in paddy and white rice was not found significant correlation. In cargo category was not found any significant correlation between examined biochemical traits (table 3).

Table 2. Correlation between some biochemical traits at paddy rice

Traits	Proteins	Fe	Zn	Cu
Carbohydrates content	0.320	-0.255	0.184	0.127
Protein content		-0.862**	0.103	-0.095
Fe			-0.170	0.042
Zn				-0.260

Level of significant p=0.01**

Table 3. Correlation between some biochemical traits at cargo rice

Traits	Proteins	Fe	Zn	Cu
Carbohydrates content	0.224	-0.015	0.138	0.153
Protein content		-0.317	0.080	-0.096
Fe			-0.187	0.057
Zn				0.259

Table 4. Correlation between some biochemical traits at white rice

Traits	Proteins	Fe	Zn	Cu
Carbohydrates content	-0.686**	-0.132	-0.098	0.041
Protein content		-0.265	-0.063	-0.161
Fe			0.277	0.477
Zn				-0.157

Level of significant p=0.01**

In table 5, 6 and 7 is given the correlation between examined biochemical traits in paddy, cargo and white rice, with examined morphological traits. The content of iron at paddy, cargo and white rice showed a negative correlation with the grain width. But the correlation is significant for both levels of significance only in paddy.

Table 5. Correlation between some morphological and biochemical traits at paddy rice

Traits	Carbohydrates content	Protein content	Fe	Zn	Cu
Culm height	0.491	0.501	-0.549	0.488	-0.001
Leaf length	-0.333	0.238	-0.281	0.340	0.002
Leaf width	0.536	0.121	0.003	-0.081	-0.066
Leaf area	0.119	0.383	-0.346	0.371	0.007
Panicle length	0.342	0.284	-0.279	0.228	-0.394
Number of grains per panicle	0.359	-0.290	0.304	0.110	-0.178
Fertility	0.272	0.569*	-0.562*	0.009	0.025
Mass of grains per panicle	0.354	-0.174	0.096	0.095	-0.318
100-grains weight	0.159	0.093	-0.271	-0.015	-0.344
Grain length	0.226	0.208	-0.286	0.401	-0.422
Grain width	0.274	0.508	-0.719**	0.189	-0.086
L/B ratio	0.0746	-0.032	0.056	0.286	-0.325

Level of significant p=0.01**, Level of significant p=0.05*

At cargo category and white rice obtained values are significant only at p=0,05. In paddy, the content of iron is negatively correlated with fertility (r=-0.562) but only at the level of significance at p=0.05. Fertility showed significant correlation with the protein content in paddy (r=0.569) and in the category cargo (r=0.636) but only at level of significance p=0,05. The content of zinc in white rice is negative significant correlation with the panicle length (r=-0.749) for both levels of significance and with trait fertility (r=-0.590) only at level of significance p=0.05.

According to Ekka et al., 2011, Sellappan et al., 2009, the grain size determines the quantity of important microelements, such as iron and zinc in grain. In researches of Ekka et al., 2012, grain dimensions are not in significant correlation with content of iron and zinc. Negative correlation between the iron content and grain dimensions and zinc content and dimensions of grains show the researches of Ya-wen et al., 2005

Table 6. Correlation between some morphological and biochemical traits at cargo rice

Traits	Carbohydrates content	Protein content	Fe	Zn	Cu
Culm height	0.473	0.470	-0.461	0.217	0.029
Leaf length	-0.325	0.319	-0.526	0.204	-0.058
Leaf width	0.402	0.084	0.371	0.144	0.2701
Leaf area	0.016	0.447	-0.297	0.412	0.242
Panicle length	0.016	0.630*	-0.112	0.123	-0.126
Number of grains per panicle	-0.008	0.085	0.440	0.455	-0.167
Fertility	0.176	0.636*	-0.332	0.151	0.162
Mass of grains per panicle	0.154	-0.020	0.274	0.237	-0.398
100-grains weight	0.415	-0.217	-0.133	-0.248	-0.491
Grain length	0.328	-0.068	-0.178	0.330	-0.507
Grain width	0.198	0.314	-0.668*	-0.340	-0.108
L/B ratio	0.193	-0.212	0.124	0.448	-0.386

Level of significant p=0.05*

Table 7. Correlation between some morphological and biochemical traits at white rice

Traits	Carbohydrates content	Protein content	Fe	Zn	Cu
Culm height	-0.003	0.129	-0.548	-0.068	-0.014
Leaf length	-0.175	0.105	-0.302	-0.031	0.223
Leaf width	0.069	-0.107	0.050	-0.335	-0.041
Leaf area	-0.102	-0.005	-0.351	-0.364	0.211
Panicle length	-0.155	0.032	-0.109	-0.749**	0.352
Number of grains per panicle	-0.389	-0.004	0.539	-0.109	0.490
Fertility	0.077	-0.086	-0.453	-0.590*	0.140
Mass of grains per panicle	-0.187	-0.094	0.404	-0.011	0.149
100-grains weight	0.364	-0.252	-0.022	0.188	-0.478
Grain length	-0.060	-0.136	-0.091	0.360	-0.396
Grain width	0.182	0.308	-0.580*	-0.414	-0.247
L/B ratio	-0.140	-0.239	0.161	0.503	-0.253

Level of significant p=0.01**
Level of significant p=0.05*

Conclusion

The analysis of correlation between some morphological and biochemical traits in thirteen genotypes of rice from Republic of Macedonia showed that the shape of the grain is significantly positive correlation with the length of grain and mass of grains per panicle with the number of grain per panicle. Fertility is in positively correlated with the leaf area. A negative correlation was found between the protein content and content of iron in paddy, and content of carbohydrates in white rice. The content of iron in paddy, cargo and white rice is negatively correlated with the grain width.

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